Impact of 4Ds on Blueprint Scenarios

J. Richard Kuzmyak,
Transportation Consultant, LLC
Caliper Corporation

Assessment of Initial Scenario Results

VMT Benefits attributable to:

- Jobs/housing balance
- Targeted elimination of longest commutes
- Greatly improved transit service
- Significant clustering around transit nodes

Preliminary Assessment:

- Primary impact is on commute travel
- Have not yet tapped land use (4D) effects

What Are the "4Ds"

Local Land Use:

1. Density
2. Diversity (mix and balance)
3. Design (walkability, connectivity)

Surrounding Land Use

4. Regional Accessibility

How the 4Ds Impact Travel

- Lower auto ownership rates due to:
  - Better regional accessibility – especially transit
  - More local opportunities lessen need for auto dependence
- Reduced vehicle miles of travel due to:
  - Fewer autos owned
  - More trips by walking
  - Shorter auto trips
- Local land use provides more alternatives for non-work travel

Key Findings from Solimar South Bay Cities Study

People who live in mixed-use centers:

- Make a high percent of their non-work trips to neighborhood center
- A high percentage of neighborhood center trips are by walk or bike
- Result is virtually *independent* of commuting behavior: most still drive long distances to work place

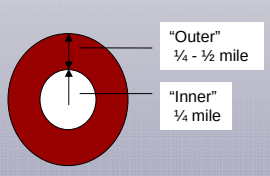
South Bay Cities Study Sites

Centers:

- Old Town Torrance
- Inglewood downtown
- Riviera Village (Redondo Beach)
- El Segundo downtown*

Corridors:

- Pacific Coast Highway
- Hawthorne*
- Artesia*
- Gardena*



* (Data not available for these sites in current analysis)

Weekly Trips by Purpose: Overall and to Town Center

	Eat Meal		Grocery Shop		Personal Shop		Entertain/Recr		School	
	All	Center	All	Center	All	Center	All	Center	All	Center
TORi	3.32	1.92	1.88	1.64	2.23	1.49	1.80	1.16	0.83	0.55
TORo	3.45	1.66	2.19	1.54	1,83	1.22	1.84	0.82	1.70	1.13
INGi	1.80	1.30	3.20	2.40	2.60	0.75	2.33	0.25	1.25	0.00
INGo	2.31	1.18	2.30	1.80	2.08	1.43	1.34	0.52	1.51	0.96
RIVi	3.13	1.78	2.61	2.20	1.86	1.39	1.60	1.50	1.41	0.92
RIVo	3.15	1.85	2.63	2.29	2.04	1.59	1.65	1.56	0.77	0.18
PCH	3.00	1.99	2.35	1.71	2.30	1.70	1.48	1.48	2.26	1.61

Percent of Trips to Neighborhood Center by Mode

	Auto	Transit	Walk/Bike/Other
TORi	39%	0%	61%
TORo	65%	1%	34%
INGi	43%	14%	43%
INGo	69%	0%	31%
RIVi	28%	0%	72%
RIVo	51%	0%	49%
PCH	73%	0%	26%

Commuting Behavior Quite Different from Non-Work

	Unemp, Retired, Work at Home	Auto	Transit	Walk/ Other	Work > 10 min from Home	Free Parking
TORi	21%	71%	2%	6%	97%	97%
TORo	15%	75%	0%	10%	83%	92%
INGi	50%	50%	0%	0%	67%	100%
INGo	28%	68%	0%	4%	90%	71%
RIVi	33%	65%	0%	2%	94%	91%
RIVo	24%	72%	1%	3%	94%	95%
PCH	29%	68%	2%	1%	92%	92%

Limitations in Using SBC Results in 4Ds Analysis

- No real “control” situations to compare against
- Samples are for individuals, not households, and do not account for key household characteristics
- Proportions are user estimated, not derived from actual trip data
- Not currently tied to any quantitative 4D measures

Other Approaches Considered

- SCAG VMT TAZ level regression model based on density and TOD (SungHo Ryu)
  - Good impacts but density a coarse measure of land use
- Adopt Mark Futterman approach
  - Only increases walk share by 2 to 4%; already being used?
- Compare places with SG characteristics with non-SG, develop adjustment factors
  - Still investigating – difficulty identifying example sites
- Reduce average trip length assumptions in TAZs with SG activity
  - Still a possibility – may be shorter in SG zones
- Reduce average trip lengths in non-work trip tables by adjusting friction factors
  - Still a possibility – but risks tampering with SCAG model integrity
- Apply VMT model approach, but with Baltimore coefficients
  - Argument that LA coefficients smaller because can't find enough local samples
  - Transferability is always a cautious process

Current Recommended Approach

- "Post-Processor" – Apply VMT factoring methods to account for 4D effects
- "Pivot" off of first stage forecasts performed with SCAG regional model
- Estimate changes in household auto ownership and VMT corresponding to land use and demographics
- Develop net VMT adjustment ratio for each TAZ, and for each scenario

Our Land Use Measures

Regional Accessibility:

- Summation of total jobs in each TAZ divided by peak period travel time from origin TAZ to that TAZ
- Our measure: Total jobs by auto PLUS total jobs by transit

Diversity:

- Land Use Mix: Proportionate balance of 12 land uses within ¼ mile of household

Design:

- Walk Opportunities: Summation of all retail and service activities within ¼ mile of household, divided by walk time
- Activities assigned SIC-based value weight adapted from 1984 survey of LA neighborhoods by Bannerjee & Baer

Vehicle & DVMT Models for SCAG Region (2001 HTS)

	Vehicles per Household				Daily Household Driver VMT			
				Baltimore				Baltimore
	Coeff	Mean	Elasticity	2005	Coeff	Mean	Elasticity	2005
Constant	0.7910				15.828			
HH Size	0.234 [39.83]	2.488	0.302	0.292	5.016 [10.18]	2.493	0.232	0.129
Workers					7.437 [8.76]	1.283	0.177	0.243
Income	0.1708 [38.39]	4.556	0.405	0.578	3.591 [10.05]	4.563	0.304	0.37
Vehicles					7.137 [9.72]	1.946	0.258	0.333
Reg Access	-0.000001 [-9.45]	173767	-0.090	-0.228	-0.00007 [-10.56]	173438	-0.226	-0.127
LU Mix	-0.1734 [-3.57]	0.2595	-0.023	-0.173	-8.469 [-2.41]	0.2597	-0.041	-0.089
Walk Opps	-0.14878 [-3.10]	0.071	-0.006	-0.396	-0.0628 [-0.023]	0.0828	-0.0001	-0.097
R-squared	0.255				0.1026			
# Observ	10,377	(HHs with DVMT <300 miles)			10,133	(HHs with DVMT <300 miles)		
	Vehicles	1.922			HH VMT	53.804		

Current and Forecast Values for SED and Policy Variables

	2001 HTS				Scenarios	
	Mean	Min	Max	Std. Dev	SG Area	Typical non-SG
HH Size	2.488	1	9	1.390	?	?
Workers	1.283	0	6	0.853	?	?
Income	4.556	1	8	1.831	?	?
Vehicles	1.922	0	8	0.956	calc	calc
Reg Access	173,767	24,578	538,364	91,072	700k+	300k
LU Mix	0.2595	0	0.821	0.171	0.8	<0.1
Walk Opps	0.071	0	6.645	0.188	5+	<0.1

Example: SG & Current SED

	HH Vehicles			HH Daily VMT		
	Coeff	Mean	TEST	Coeff	Mean	TEST
Constant	0.7910		0.7910	15.828		15.828
HH Size	0.234 [39.83]	2.488	2.488	5.016 [10.18]	2.493	2.488
Workers				7.437 [8.76]	1.283	1.283
Income	0.1708 [38.39]	4.556	4.556	3.591 [10.05]	4.563	4.556
Vehicles		**1.922**	**1.117**	7.137 [9.72]	1.946	**1.117**
Reg Access	-0.000001 [-9.45]	173767	**300000**	-0.00007 [-10.56]	173438	**300000**
LU Mix	-0.1734 [-3.57]	0.2595	**0.800**	-8.469 [-2.41]	0.2597	**0.800**
Wtd Opps	-0.14878 [-3.10]	0.071	**4.000**	-0.0628 [-0.023]	0.0828	**4.000**
				HH VMT	**53.80**	**34.18**

Example: Non-SG & Current SED

	HH Vehicles			HH Daily VMT		
	Coeff	Mean	TEST	Coeff	Mean	TEST
Constant	0.7910		0.7910	15.828		15.828
HH Size	0.234 [39.83]	2.488	2.488	5.016 [10.18]	2.493	2.488
Workers				7.437 [8.76]	1.283	1.283
Income	0.1708 [38.39]	4.556	4.556	3.591 [10.05]	4.563	4.556
Vehicles		**1.922**	**2.077**	7.137 [9.72]	1.946	**2.077**
Reg Access	-0.000001 [-9.45]	173767	**50000**	-0.00007 [-10.56]	173438	**50000**
LU Mix	-0.1734 [-3.57]	0.2595	**0.100**	-8.469 [-2.41]	0.2597	**0.100**
Wtd Opps	-0.14878 [-3.10]	0.071	**0.050**	-0.0628 [-0.023]	0.0828	**0.050**
				HH VMT	**53.80**	**64.71**

Example: SG & Larger HHs

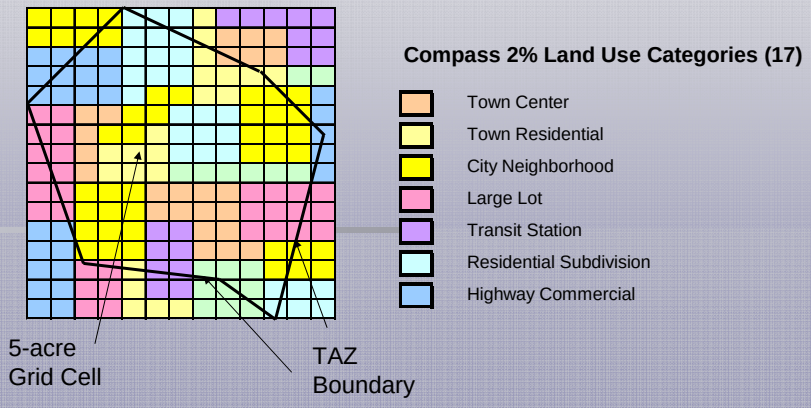
	HH Vehicles			HH Daily VMT		
	Coeff	Mean	TEST	Coeff	Mean	TEST
Constant	0.7910		0.7910	15.828		15.828
HH Size	0.234 [39.83]	2.488	**3.000**	5.016 [10.18]	2.493	**3.000**
Workers				7.437 [8.76]	1.283	**1.36**
Income	0.1708 [38.39]	4.556	4.556	3.591 [10.05]	4.563	4.556
Vehicles		**1.922**	**1.237**	7.137 [9.72]	1.946	**1.237**
Reg Access	-0.000001 [-9.45]	173767	300000	-0.00007 [-10.56]	173438	300000
LU Mix	-0.1734 [-3.57]	0.2595	0.800	-8.469 [-2.41]	0.2597	0.800
Wtd Opps	-0.14878 [-3.10]	0.071	4.000	-0.0628 [-0.023]	0.0828	4.000
				HH VMT	**53.80**	**38.18**

Example: Non-SG & Larger HHs

	HH Vehicles			HH Daily VMT		
	Coeff	Mean	TEST	Coeff	Mean	TEST
Constant	0.7910		0.7910	15.828		15.828
HH Size	0.234 [39.83]	2.488	**3.000**	5.016 [10.18]	2.493	**3.000**
Workers				7.437 [8.76]	1.283	**1.36**
Income	0.1708 [38.39]	4.556	4.556	3.591 [10.05]	4.563	4.556
Vehicles		**1.922**	**2.077**	7.137 [9.72]	1.946	**2.077**
Reg Access	-0.000001 [-9.45]	173767	50000	-0.00007 [-10.56]	173438	50000
LU Mix	-0.1734 [-3.57]	0.2595	0.100	-8.469 [-2.41]	0.2597	0.100
Wtd Opps	-0.14878 [-3.10]	0.071	0.050	-0.0628 [-0.023]	0.0828	0.050
				HH VMT	**53.80**	**68.70**

Application to Forecasting

Depiction of Land Use in Future Scenarios



Values of 4D Variables for Individual Grid Cells

Development Type	Resid	Empl	Ret/Svc	Reg Acc	LU Mix	Walk Opps
Downtown Center	8%	75%	17%	Calculated for each cell by x,y coordinate	Low	M High
Downtown Residential	57%	0%	43%		M High	High
City Center	38%	24%	38%		High	High
City Residential	72%	5%	23%		M High	High
Town Center	60%	20%	20%		M High	High
Town Residential	95%	0%	5%		Low	Med
City Neighborhood	95%	0%	5%		Low	Med
Residential Subdiv	100%	0%	0%		Poor	Poor
Large Lot	100%	0%	0%		Poor	Poor
Rural Cluster	100%	0%	0%		Poor	Poor
Activity Center	35%	50%	15%		M High	M High
Transit Station	80%	4%	16%		M High	M High
Transit Corridor	87%	0%	13%		M High	M High
Main Street	60%	0%	40%		M High	High
Office Park	0%	100%	0%		Poor	Poor
Industrial	0%	100%	0%		Poor	Poor
Highway Commmerc	45%	0%	55%		Med	Low

Calculating VMT for TAZ

VMT, TAZ *i* =
SUM (VMT, Grid Cell *j* x Households, Grid Cell *j*)

over all cells in TAZ i

Where

VMT in Grid Cell *j* =
f (HH Size, Income, Workers, Vehicles,
Regional Accessibility, LU Mix, and Walk Opps)

Do this for each TAZ in all scenarios – GV 2% & Base

Next Steps

- Try some additional model formulations
  - Study selected “smart growth” areas
  - Test additional variable formulations
  - Test apply elasticities from Baltimore model
- Conduct Analysis for RTP
  - Estimate VMT effects for all scenarios
  - Compare key differences across scenarios
  - Recommend final adjustments